REMARKS

Claims 1 and 4-11 remain in this application. Claims 1 and 4-10 are amended. Claims 2-3 and 12-16 have been canceled and claims 17-27 are added as new claims.

The present invention provides a method for analyzing rotating motor driven systems in which time domain current waveform information is gathered from a motor driving the system, and the time domain waveform is normalized to spatial domain information, and is subsequently converted to the frequency domain to identify system characteristics with reference to spatial positions of the system. The normalization of the time domain information to the spatial domain is performed with reference to rotation of the motor, using motor current peak information comprising a predetermined number of peaks to identify a predetermined rotational travel of the motor, such that information relating to movement and position of the system components is available for the frequency domain analysis of the system.

Claim 12 was rejected under 35 U.S.C. §102(e) as being anticipated by Palanisamy et al. (US Patent No. 6,553,816). Claim 12 and the claims dependent therefrom have been canceled, such that the present rejection is deemed moot.

Claims 1, 4-7 and 9-11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Palanisamy et al. in view of Kliman (US Patent No. 6,199,023). Palanisamy et al. disclose using sensed information from an engine being driven by a starter motor as "spatial markers" to analyze a time domain starter motor current waveform, where the "spatial markers" comprise crank position data obtained from a crank position sensor, ECU, fueling system or ignition system, along with engine firing order, to represent the monitored current and times into cylinder data frames or modules, see column 4, lines 53-62. Palanisamy et al. do not disclose or suggest identifying a predetermined number of current peaks, or any other current characteristic, to correspond to a predetermined rotational travel of the motor.

Kliman discloses removing spurious signals in a process of motor current signature analysis of an electric motor including creating an electronic model of the motor. In particular Kliman discloses a method including acquiring simultaneous measurements of voltage and current at the motor, applying the measured voltage to the motor model and determining an equivalent current produced in the motor model

by the applied voltage, subtracting the equivalent current from the measured current to produce a corrected motor current and then processing the corrected motor current through conventional motor current signature analysis.

Claim 1 has been amended to recite identifying a predetermined number of brush-switching peaks corresponding to a predetermined rotational travel of the motor. In the described embodiment of the present invention, an example of a motor is described in which the motor produces 52 brush-switching peaks that may be used as a basis for identifying each full rotation of the motor. Palanisamy et al. do not disclose identifying the number of brush-switching peaks in a current waveform corresponding to a predetermined rotation of the starter motor. Similarly, Kliman fails to reference a step of identifying a number of brush-switching peaks in a current waveform corresponding to a predetermined rotation of a motor. Further, Kliman provides no teaching, either explicit or implied, of using a motor current waveform characteristic, including a predetermined number of peaks, corresponding to a predetermined rotational travel of the motor.

In a normal operation of a DC motor, the speed of the motor may vary throughout a rotation of the motor, such that the spacing between data points corresponding to equivalent rotational increments of the motor may not be equally spaced in a time domain current waveform. To address the variations that may occur in the time domain current waveform, the invention of claim 1 includes the step of normalizing the time domain current waveform to a spatial domain waveform based on the predetermined number of brush-switching peaks produced in the motor for driving the system. The normalization includes setting a width of the time domain current waveform equal to a predetermined number of equally spaced increments providing data points defining a waveform in the spatial domain which corresponds to the predetermined rotational travel of the motor. The width of the current waveform is set based on the predetermined number of brush-switching peaks of the motor, and permits normalization of time domain data from the system to the spatial domain without additional acquisition of information from any component of the system other than the motor for driving the system.

Neither Palanisamy et al. nor Kliman disclose or teach obtaining information based on a predetermined rotational movement of a motor, as derived from a sensed

motor current including identified brush-switching peaks, and using the brush-switching peak information to normalize the time domain waveform to a spatial domain waveform. Although the Examiner referenced Kliman as disclosing an ideal motor signal which "would contain oscillations caused by segment switching and corresponding to one rotation of the motor," there is no mention in Kliman of identifying motor segment switching, or of any application of motor information, to normalize a waveform from the time domain to the spatial domain. Accordingly, there is no teaching to modify the invention of Palanisamy et al. to perform the presently claimed normalization of a current waveform based on identified peaks in the current waveform corresponding to a predetermined rotation of the motor. The other references cited by the Examiner have been reviewed, and none of the additional cited references appear to address identifying peaks in a motor current waveform to provide a normalization of the waveform from the time domain to the spatial domain. Accordingly, claim 1 and the claims dependent therefrom are considered to be allowable over the cited prior art.

New independent claims 20 and 24 are added by the present amendment and similarly recite identifying a predetermined number of peaks in a current waveform of a motor corresponding to a predetermined rotational travel of the motor, where the time domain current waveform is normalized to the spatial domain based on the identified predetermined number of peaks in the current waveform. Accordingly, independent claims 20 and 24 and dependent claims 21-23 and 25-27 are considered to be allowable for similar reasons to those given above for claim 1.

In view of the foregoing amendments and remarks, it is respectfully submitted that claims 1, 4-11 and 17-27 of the present application are in condition for allowance.

If the present amendment raises any questions or the Examiner believes that an interview would facilitate prosecution of the present application, he is respectfully requested to contact the undersigned attorney.

Respectfully submitted,
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